

## **A METHOD AND SYSTEM PROVIDING A DIGITAL CINEMA DISTRIBUTION NETWORK HAVING BACKCHANNEL FEEDBACK**

This application claims priority of U. S. provisional patent application No.:  
5 60,262,608, filed on January 18, 2001.

### **BACKGROUND OF THE INVENTION**

#### **1. Field of the Invention**

This invention relates to a digital distribution network system, and in particular to a  
method and a system for distributing digital video, audio, and data content.

#### **2. Description of the Related Art**

Digital cinema is changing the manner in which films can be captured, delivered and  
viewed. Digital cinema promises to transform the movie industry, as it will allow for the  
shooting, editing, and distribution of a film to be completed entirely electronically.

Currently, the distribution of digital content is hindered by several factors including,  
20 for example, costs of converting to digital cinema technology, the limited bandwidth of  
available transmission networks and the security of digitally transmitted content.

Notwithstanding these factors, the demand for digital cinema is increasing. This  
increasing demand for digital cinema can be attributed, in part, to the benefits of digital  
25 cinema, such as, cost savings in the production, processing, and distribution of content.

PCT Publication Number WO 99/66728 discloses a system and method for secure  
electronic delivery of motion pictures in digital format to many end users simultaneously.  
The system includes a studio-distributor management system, a headend system, a theater  
30 system, and a creator/editors system. Another example can be found in PCT Publication

Number WO 00/34825. This publication is related more specifically to a control system for a multi-projection room cinema.

What is needed is a digital distribution system that provides an efficient and flexible means for taking advantage of the rapidly changing digital cinema technology.

## SUMMARY OF THE INVENTION

180052915-011002  
200110-51625008

The teachings herein provide a digital distribution network (DDN) for the distribution of digital cinema content, including digital video, audio, and data, to end locations, typically digital cinemas or theaters. It is also within the scope of the teachings herein that the DDN distribute digital cinema content to home theaters, residences, PDAs, cell phones, and similar devices. The DDN described herein is flexible as it can be configured to provide the distribution of pre-recorded content, live content, video games, video conferencing, interactive content, and combinations thereof, in a variety of configurations. The DDN provides an end-to-end distribution system and method for digital content. The DDN also has an ability to control event scheduling, transmission of scheduling software, bi-directional teleconferencing for screenings and audience monitoring. The DDN can be remotely controlled and configured. Moreover, the operational status or health of the DDN, and each theater, may be remotely monitored and alarmed via a back channel that transmits information to a central location.

The DDN in accordance with these teachings furthermore provides a networked feedback mechanism, which may be wired or wireless, for audience monitoring. The DDN also includes an interface with a global data communications network for enabling theater viewers to interactively receive information concerning a scene being displayed, and for commenting on the DDN distributed films using, for example, web forums, chats, and email.

Furthermore, the DDN provides a secure network using encryption methods (e.g., IPSEC, NIST AES, and presently preferred 3 DES encryption techniques).

The transmission and event scheduling software is accessible via an internal Extranet.

In one aspect this invention provides a digital content distribution and viewing system  
5 that includes a source of at least one of pre-recorded or live digital content; a transport mechanism for distributing the digital content to a plurality of theater locations where the digital content can be viewed by an audience and, at the plurality of theater locations, video cameras for generating live video of the audience for transport to one or more viewing locations.

In another aspect this invention provides a digital content distribution and viewing system that includes a source of at least one of pre-recorded or live digital content; a transport mechanism for distributing the digital content to a plurality of theater locations where the digital content can be viewed by an audience; at the plurality of theater locations, audience input devices for generating audience input signals; and a backchannel for transporting the audience input signals to one or more locations. The backchannel can be implemented using any public or private telecommunications connection, including the Internet.

In a further aspect this invention provides a digital content distribution and viewing  
20 system that includes a source of at least one of pre-recorded or live digital content; a transport mechanism for distributing the digital content to a plurality of theater locations in combination with at least one script, where the theater locations enable the digital content to be viewed by an audience with theater equipment; at the theater locations, a store and forward server for receiving the digital content and the at least one script, and for executing the script  
25 for controlling actions of the theater equipment during the viewing of the digital content; and a backchannel for transporting to a central site a log that is descriptive of at least some of the actions and equipment capabilities, and an associated time stamp of when the action was performed.

In a still further aspect of this invention a digital content distribution and viewing system includes a source of at least one of pre-recorded or live digital content; a transport mechanism for distributing the digital content to a plurality of theater locations in a compressed, encrypted format using a first encryption technique, where the theater locations enable the digital content to be viewed by an audience with theater equipment; at the theater locations, a store and forward server for receiving said digital content, the store and forward server having an output coupled to an input of a digital projection system and operating to decompress and decrypt the digital content, and for encrypting the digital content using a second encryption technique before transmitting the digital content to the input of the digital projection system.

In yet another aspect, this invention provides an embodiment wherein there is interposed, between the output of the store and forward server and the digital projection system or inside the projection head, an interface module operable for decompressing and decrypting the digital content, and for encrypting the digital content using a second encryption technique before transmitting the digital content to the input of the digital projection system. In this latter embodiment the second encryption technique may include "light" encryption techniques such as data scrambling, and the interface module may include an MPEG codec. Fractal compression, wavelet compression, Multi-Layer DCT, and Adaptive Block Size DCT may also be used. It is also within the scope of the present invention that the transmitted audio and/or video be distributed in an uncompressed format.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an overall block diagram of an embodiment of the DDN of the present invention;

FIG. 2 is a block diagram depicting a satellite network transmission aspect of the DDN;

FIG. 3 is a block diagram of one embodiment of a DDN originating site for receiving input from a terrestrial network and a DDN satellite uplink;

FIG. 4 is a block diagram of a second embodiment of a DDN originating site having a satellite downlink and a DDN satellite uplink;

FIG. 5 is a block diagram depicting a first embodiment of a satellite network transmission and video conformance aspect of the DDN for the distribution of live events to both theaters and the DDN originating site for re-transmission on the network;

FIG. 6 is a block diagram depicting a further embodiment of a satellite network transmission aspect of the DDN for the conformance and distribution of live events to the DDN originating site for re-transmission on the network;

FIG. 7 is a block diagram of theater equipment and signal flow of the DDN of FIG. 1;

FIG. 8 is a block diagram of a teleconferencing configuration of the DDN of FIG. 1;

FIG. 9 is a block diagram illustrating an embodiment of the theater equipment configuration, including teleconferencing capabilities for the DDN;

FIG. 10 is an overall block diagram of the system architecture for the DDN of FIG. 1;

FIG. 11 depicts an exemplary film event script;

FIG. 12 depicts an exemplary live event script;

FIG. 13 is a block diagram of a further embodiment of this invention, wherein an interface unit is disposed between the store and forward server and the digital projection head; and

2025-05-15 10:18:02

FIG. 14 is a high level block diagram showing a content data stream output from the store and forward server to the interface unit of FIG. 13, where the content includes embedded metadata for configuring the interface unit.

5

## DETAILED DESCRIPTION OF THE INVENTION

As employed herein an "action" refers to any command acted upon by theater equipment. For example, closing the auditorium curtains or displaying a still image for 30 seconds are both examples of an action. Certain actions are recorded in a log with an associated time stamp and provided through a backchannel to a central control site so as to enable, for example, the tracking of the unauthorized use of film content and/or the tracking of advertisements played for viewers. The word "content" refers to a smallest displayable entity, for example, a single still frame, piece of video, or a single file. An "event" is one of a plurality of defined uses for a DDN (Digital Distribution Network) 1, such as viewing pre-recorded video, viewing live events, or video teleconferencing. A "program" is a group of actions that form a portion of an event or all of an event. A "script" is a mechanism by which a program performs actions. A "theater server" or "video server", also referred to herein as a "store and forward server" and a "store/forward server" is a hardware/software device that stores, schedules and makes content available for play. Decoder as used herein should be understood to include at least the functions of decoding video images and decoding signals from the network (satellite or otherwise) that are to be sent to the video decoder.

0052915-011802

20

25

30

With general reference to the accompanying figures, and in particular to FIGS. 1, 7, 9 and 10, the overall system architecture of the DDN system 1 is described. DDN system 1 is referred to hereafter simply as the DDN 1. DDN 1 provides for the distribution of digital content, including video, audio, and data, to a plurality of theaters 2 from a content origination center 3 as well as from other sources. Other sources of content include, for example, a live feed source 6. The content can be any combination of video, audio, and data distributed as, for example, pre-recorded 5 or live content 6. A feature of the present invention is a capability for DDN 1 to provide bi-directional video teleconferencing between

theater 2 using a live audio/video system 7 located at theater 2. The bi-directional teleconferencing content is routed to a broadcast booth 50 via a live video/audio compression system 85, a caching server 80, a data router 45 and a network interface 40. Network interface 40 can interface with a wireless (e.g., satellite) and/or a terrestrial network.

5

A backchannel 4 is provided and may be established, for example, via a return transponder link through a satellite and/or a wired or wireless terrestrial data communications network, such as a terrestrial communications network or the Internet. A combination of different paths and transport mechanisms may be employed in tandem to implement backchannel 4.

Content server 10 can accommodate live content 6 and pre-recorded content 5. A further input to the uplink site 25 can be optional third party content that is sent directly to the uplink site 25. Content server 10 may receive live 6 and/or pre-recorded 5 content data from a variety of content origination source locations. Content server 10 may be implemented as a component of a content transport system 65 that may include a satellite transponder 30 associated with an uplink site 25 and a plurality of downlink sites 35. Each of downlink sites 35 is preferably associated with a theater 2 (see FIGS. 2 –6). Content server 10 is coupled to uplink site 25 via an appropriate intra-network 20. Downlink site 35 located at the theater 2 may include a satellite dish located on a roof of theater 2. A terrestrial network router 45 enables the content to be delivered via a terrestrial data network to those theaters 2 that do not support a satellite receiver downlink site 35.

At theater 2, a network interface unit 40 receives the transmitted content via transport mechanism 65, demodulates the transmission, and provides a digital output to router 45. Router 45 is connected to a caching server 80 on a LAN that may include a type of mass storage system for storing transmitted content received from content server 10, broadcast booth 50, and/or the third party providing third party content 21. A caching server 80 is coupled to store and forward server 75 (hereinafter store/forward server 75) or provides the functionality of a store/forward server. Store and forward server 75 provides an output of the

transmitted content to an audio playback system 110 via, for example, an AES link. Store and forward server 75 provides another output to a decryption and digital projection system 105 via an AV matrix 84. AV matrix 84 includes a digital projection system and may be any one of several commercially available digital projection systems. AV matrix 84 facilitates coupling multiple data content transmissions to projection system 105. Examples of suitable projection systems currently available include Texas Instruments Digital Light Processing™ (DPL) projectors, and Hughes-JVC's Direct-Drive Image Light Amplifier™ (D-ILA) projectors.

Caching server 80 (e.g., a PC) provides control, reporting, error logging, buffering and additional storage, if required. Caching server 80 directly, or store/forward server 75, provides a control output to a theater automation system 100. Theater automation system 100 is used for controlling theater lighting, a theater curtain (if present) and other automated theater controls, such as masking for different aspect ratios and lens changes. All of the functions controlled by theater automation system 100 are preferably coordinated by downloaded script files executed by store/forward server 75.

An aspect of these teachings is the ability to provide video and audio signals generated at theater 2 using one or more live video feeds 95 and microphones 90. The outputs of live video feeds 95 and microphones 90 are provided to a live video/audio compression system 85 that provides compressed video/audio signals to caching server 80. Caching server 80 in turn relays the compressed video/audio signals to terrestrial network router 45. From router 45 the live video/audio content can be transmitted to broadcast boot or telecommunications bridge 50. In this manner, and by example, a group meeting at theater 2 can conduct bi-directional, live video conferencing with one or more other persons located at, for example, a content origination location.

The live video feed(s) 95 and microphone(s) 90 can also be used to monitor the reactions of a test audience or focus group that is viewing an event, such as a film or an advertisement. The focus group can be monitored in real time at, for example, a content



origination location such as a film studio or any other point, or the live video/audio signals can be stored at the live video/audio compression system 85 (or another location) for subsequent playback. Timing signals received from the store/forward server can also be recorded by live video/audio compression system 85 for correlating the captured audience reactions to the content that invoked the recorded reactions.

In one aspect of the present invention, one or more of the live video feeds 95 may employ IR or low light cameras for viewing the audience under low-light theater conditions during the projection of the content. In addition, the audience may provide feedback on the content, be provided additional information regarding the content, or interact with the content via wired devices at each seat or wireless feedback devices, such as cell phones or PDAs.

In a preferred embodiment, the content leaving content server 10 is strongly encrypted to discourage unauthorized interception and viewing or recording of the transmitted signal. A function of the store/forward server 75 is to remove the strong encryption prior to playout, and to preferably provide in its place encryption on the link between store/forward server 75 and the decryption and projection unit 105, thereby discouraging unauthorized recording of the content in theater 2. In other embodiments, decryption/projection system 105 may be implemented and configured for removing the strong encryption, thereby eliminating this function from store/forward server 75.

It will be appreciated by those skilled in the art that various types of digital content can be distributed using the present invention, and that DDN 1 may be arranged in a variety of configurations. That is, the embodiment depicted herein are not intended to be viewed in a limiting sense upon the scope and practice of these teachings. Although DDN 1 is discussed herein primarily in the context of distributing digital content, either pre-recorded or live, to theaters 2 for viewing, and providing a video teleconferencing functionality, this is done in order to illustrate, and not limit, the teachings of this invention.

#### Viewing pre-recorded content

Referring to FIG. 1, content server 10 receives pre-recorded digital content 5 from a content source, such as from a content server controlled by the owner/provider of DDN 1. Caching server 80 located in theater 2 is polled or scheduled for communicating with content server 10 for providing content to caching server 80. Content server 10 may operate to “push” content to the theater-located store/forward servers 75. Content is requested or “pulled” in other embodiments. Content can also be sent to theater 2 and ingested into the caching server or store/forward server 75 using high density media. At theater 2, the store/forward server 75 receives content, stores it for archival purposes and forwards the content to other components of the theater-located system, including decryption and projection system 105 and audio playback system 110.

Store and forward server 75 located in a theater may be uniquely designated, either automatically or by a system administrator, to wait until content is flagged for reception. Backchannel 4, in some instances very small (e.g., a 56kbps dedicated dialup), is preferably provided so that various aspects of theater 2, including store/forward server 75, can be monitored, controlled, and updated with new scheduling scripts.

According to transmission scheduling software that is itself distributed to theaters 2, content is pushed to store/forward server 75 of the DDN 1. The time for displaying a film can be coordinated by, for example, a local marketing manager using an internal Extranet, or by any other suitable means.

At the beginning of an event, such as a film showing, theater automation system 100 identifies, via backchannel 4, the physical parameters of theater 2 and parameters of the equipment used for playback via a hardware abstraction layer present in all of the equipment. The execution of an event is described and specified by a collection of nested scripts, encapsulated into an overall event script that controls the event execution. The event script may be nested into a script that is executed by store/forward server 75 for controlling theater 2 for a given period of time, such as a day or a week. The event script is typically associated

with real time so that the scheduled events can be executed at the proper time and in the proper sequence. All other scripts can be time-independent.

Any of a number of suitable scripting languages may be employed. Examples of film and live event script are shown in FIGS. 11 and 12, respectively. The scripts are preferably distributed to store/forward server 75 as metadata along with the content that is to be viewed in theater 2.

In a presently preferred, but not limiting embodiment, an event begins with an advertising program containing still frames, video footage, and audio. The use of curtains, lights, and other cinema controls depends on a particular theater's facility. The script specifying the order and duration of the advertisements is sent to caching server 80 and forwarded to store/forward server 75 for execution. Store and forward server 75 may default to, by example, 29.97fps, or to the local television standard frame rate. All event duration calculations will be based on the operational frame rate. Store and forward server 75 preferably operates to mix at least two stereo audio streams. As the advertising program commences, a background audio stream is played using audio system 110. Audio files can also be linked to advertising content or, in the case of video content, embedded in the video file. The duration of the audio file event is set to match what is specified in the program script. Error checking may be provided on the script when it is generated and before it is loaded to store/forward server 75.

Content with attached audio may play over background music or preempt background music entirely. All audio transitions may be performed using a level fade. Store and forward server 75 preferably supports common audio formats. Video material (i.e., non-still frames) shown during the advertising program is recorded or scaled to the default rate before entering store/forward server 75. In addition, all material is preferably scaled to the standard resolution of digital projector 105 prior to entering store/forward server 75. The advertisements are preferably scaled to display properly with anamorphic and non-anamorphic films, depending on the main event content's needs. In the preferred

embodiment, DDN 1 uses the current native resolution of a Digital Light Processing (DLP) chip that forms a part of digital projection system 105.

In operation, the advertising program can be scripted to loop or to continuously fill the time between the end of an event (e.g., feature film) and the beginning of another event (e.g., the display of a movie trailer). The theater house lights are preferably dimmed to an appropriate level by theater automation system 100, and the trailer program starts. The trailer sequence is preferably treated like the advertising program discussed above. Trailers are encoded as described above so that there is no frame rate difference between advertising and trailer programs. Once the trailer program then finishes, the theater lights are then dimmed to their final level and any necessary adjustments are performed by theater automation system 110 in preparation for the playback of the pre-recorded film content 5. Film content 5 starts, appending multiple files in real time (using cuts or timed fades) for display. When the film is finished the next program or event starts.

A standard program audio used by DDN 1 is 5.1 digital audio. The system format can work in combination with Digital Theater System (DTS) or other audio formats such as Dolby E and Sony's SDDS, including multiple channel, uncompressed audio formats.

Some predetermined amount of time is preferably allotted for allowing cleaning of theater 2. The allotted time can be used as a buffer in case there are timing errors during the playback of the previous event script sequence or other timing delay circumstances. Caching server 80 is coupled to store/forward server 75 logs all aberrations such as timing delays.

An example of a typical prerecorded film event script is shown in FIG. 11. Nested scripts, as explained above, are used to control the entire event execution process. DDN 1 also preferably has some manual system function incorporated therein so that the timing of events (e.g., film showings) can be modified. For example, a theater manager may manually control caching server 80 to delay the showing of a film (i.e., override or modify an event

script). Preferably, manual control inputs will be flagged, monitored, and analyzed for system status purposes.

#### Viewing a live event

5 In an aspect of the present invention, live events may be coordinated by a local marketing manager via an internal Extranet. The operational frame rate for the live event is preferably matched to the local television standard and switched at the beginning of the event. All content, including the live event and any advertising prior to it, is mixed into the stream broadcast style. An ATSC decoder 82 decodes and passes the live content stream through AV matrix 84 to projector system 105 that displays the digital content. For this scenario, DDN 1 is configured to stream high-bandwidth, high-definition video to each theater 2. Backchannel 4, e.g., approximately 56 kbps, is used to monitor network and equipment health located at theater 2. An exemplary, simplified live event script is shown in FIG. 12.

#### Video teleconferencing

10 In another aspect hereof, and referring to FIG. 8, each theater 2 may be provided with live feed video camera system 95 for video teleconferencing. Teleconferences may be coordinated by local or regional marketing managers via an internal Extranet. An appropriate amount of bandwidth of DDN 1 is preferably made available for the transmission of the teleconference content. The frame rate is preferably matched to the local television standard and switched at the beginning of the event, and proceeds as a one-to-many and many-to-many video teleconferencing or broadcast application. Before the event begins a check is made to ensure that video cameras 95 at each theater 2 are functioning and the allotted bandwidth is appropriate for each one.

15 The teleconferencing event begins, for example, with either a one-to-many teleconference or a videotape being played. If a video is played, it is mixed, broadcast style, into the video stream. When the videotaped segment is over, a moderator can open the discussion up to each location. Ideally, an aggregate backchannel 4 of approximately 10Mbps

can be maintained from each content origination point. In this aspect, it is desirable to provide a viewing center and a control room 165, at least one remote viewing facility 170 and/or stream the content to the Internet.

## 5 Marketing Research Groups

Marketing research groups, including focus groups for gathering marketing data, may be assembled and coordinated by regional marketing managers via the internal Extranet. The entire bandwidth of DDN 1 may be made available, if necessary, for the transmission of the focus group. The frame rate is determined and set at the beginning of the event.

The marketing research group application has a unique set of features. For example, there are low-light-level video cameras 95, or IR cameras, mounted in the theater 2 in such a way as to cover the entire audience (for example, either one camera 95 with a fisheye lens or four cameras 95 positioned in each quadrant of the theater auditorium or multiple cameras with remote pan, tilt, and zoom functionality). There are also one or more of the microphones 90 that record audience reaction, but, preferably, filter out the program material. This information, which may be suitably compressed by the optional compression unit 85, can be recorded on media such as, standard definition Mini-DV tapes by a MiniDV VCR 85 (see FIG. 9) or other recording mechanisms and/or transmitted over backchannel 4, in association with time codes output from the store/forward server 75 (or an ATSC decoder), in time code synch with a projected film.

The start of a marketing research group event is similar to that of a film. Store and forward server 75 has the option of showing trailers and other filler before the event begins. When the film starts, the output of each camera 95 may be multiplexed and sent back via the backchannel 4 to an optional viewing area (165, 170) for interested parties, such as studio executives, directors, producers, etc. to view. Time code information is preferably also sent to the optional viewing area to synchronize viewing of audience reaction to the distributed content. When audience reaction is recorded, analysis of the gathered market research data may be performed at a later date.

The foregoing description provides an overview of the presently preferred embodiment of DDN 1. Further details are now provided as to various specific and exemplary implementations of DDN 1.

5

A 45Mbps (DS3) connection to an uplink provider, that provides and maintains the uplink equipment 25, can be installed as part of the transport segment 65. The bandwidth of DDN 1 can be expanded by leasing or renting, on an as-needed basis, an additional satellite transponder.

A wide-area terrestrial data communications network may also be employed as part of the transport segment 65 to provide the content to various theaters 2. One benefit of using the terrestrial network is that the available bandwidth can be readily increased to any desired amount for providing streaming video and audio of very high quality.

Another alternative of the present invention includes using a physical distribution network. That is, all distributed data and content are transferred manually using a portable recording medium (e.g., a DVD) and human interaction.

20 In the preferred embodiment, all of the applications for the network system are preferably Web browser-based. Feedback is gathered from the Web, comprising part of transport segment 65, and through wireless devices (an extension of the Web). Web sites are preferably timed or synchronized to the flow of content so that theater goers can access, in theater 2, details about the scenes currently being displayed in theater 2 and pages are  
25 accessible via the Web for viewers to comment about the films. In addition, Web boards (commonly called forums), chats, and e-mail are preferably also made available.

Viewers in theater 2 can be linked to backchannel 4 that can include the Internet. Viewers can be provided with handheld wireless devices for generating Web queries. In a  
30 presently preferred embodiment DDN 1 supports wireless viewer feedback mechanisms such

as WAP enabled devices, iMode, wireless Ethernet, and Bluetooth. Viewers may be enabled to enter queries and the like using personal digital assistants (PDAs) and other portable wireless devices. Small displays can be used by viewers for viewing responses, Web pages and the like. Content server 10, or another server, can be used for interacting with the viewers in the various theaters 2. An optional kiosk may also be employed at or as a point of sale (POS) for enabling users to register comments and reviews concerning a film that they have viewed, and to couple these comments and reviews via the backchannel 4 to the content origination location, or to some other location(s). The output of the optional POS kiosk can be coupled to the Internet for the purpose of communicating viewer provided comments and reviews to a content origination (or other) location. Wired or wireless devices may also optionally be built in to theater seats to allow viewers to register feedback, comments and reviews.

It can be appreciated that DDN 1 described thus far supports the distribution of a variety of digital video resolutions, and furthermore provides an ability to implement bi-directional, interactive teleconferencing to and from each theater 2. An ability to stream feeds into each theater 2 is also provided, enabling live events to be simultaneously viewed in each theater 2. DDN 1 also provides an ability to store content, a capability to forward content to various locations, a capability to provide for program and auditorium management, including scheduling, monitoring and reporting of DDN 1 events and status. Screen management software can be used to allow regional managers to (1) program screens from a pool of available content, and (2) provide teaser trailers and advertisements on theater screens or on plasma screens, in theater lobbies. Advertising management software can be employed to manage advertisement placement on screens. An ability to pull content directly from the store/forward servers is also provided, as is an ability to support a fade or a cut between programs that provides a mechanism to adjust credits or certain scenes for particular markets. A capability is also provided to support text overlays or character generators such that alternate subtitles can be chosen by the theater management software or metadata included with the content. DDN 1 is capable of managing video from 25Mbps (and lower) through at least 15Gbps, and furthermore has an ability to synchronize program material to time code or



genlock it to any other node on the network. An ability is provided to support alternate soundtracks that can be selected by the theater management software or metadata included with the distributed content. Also provided is an ability to support most common audio formats (e.g., mono, stereo, Dolby stereo, 5.1, 7.1, 10.2, etc.).

5

In another aspect hereof, when the final cut of a film is made it is then ready for digitization, compression, encryption, and transmission. The (post-filming) digitization step is not necessary for digitally recorded films. Video encoding and decoding for the store and forward content may be handled by the video servers, such as content server 10, and store and forward (video) server 75. Live content can optionally be compressed prior to transmission using, for example, MPEG compression technology or any other suitably applicable compression technology.

The digital audio system may also use encrypted audio, and the bandwidth thereof may be limited to 1Mbps or less. It will be appreciated by those skilled in the art that the transmitted audio signal could be uncompressed and the bandwidth used thereby could be, for example, 1.8Mbps for 12 channels of uncompressed audio.

In a preferred embodiment, content within DDN 1 that is used for exhibition is encrypted. Decryption may be handled by store/forward server 75 and/or by digital projector 105, if the projector is so enabled. In another embodiment described below in reference to FIGS. 13 and 14, the decryption is accomplished by an intermediate interface unit 76 that is disposed between store/forward server 75 and digital projection system 105. Preferably any decryption scheme that is selected for use may be up-graded as desired either by firmware or hardware. If programming is distributed on DVD-ROM, each DVD is preferably encrypted and password protected, and is also serialized. Also, watermarks may be used on a per screen basis, so that any bootleg (i.e., unauthorized) copy of a program or film content can be identified by place and time.

10052915-011802

5 In the preferred embodiment of DDN 1, occurrences of digital content transfers to each theater 2 are logged. Each program that is played is also logged in theater 2 and subsequently reported using backchannel 4. Storage needs are constantly assessed using reports from the Extranet system to manage and maintain sufficient storage capacity on the caching server 80, as well as on store/forward server 75. Caching server 80 preferably employs a RAID 0+1 scheme of mass storage, though additional or alternative mass storage formats are within the scope of the invention. Bandwidth usage is also preferably monitored and reported, which can be an important consideration for live event planning, as well as for scheduling the delivery of content to the theaters. The health of DDN 1 (including network latency and integrity) is monitored in real time using, as one suitable example, a Novell™ Managewise software package. Alarms are set if a server does not respond to command and control input from the DDN 1 broadcast booth 50. It is desirable that each component of DDN 1 be SNMP compatible. Additional device monitoring and control can be performed by the scheduling and monitoring software included as part of DDN 1.

20 In the preferred embodiment all interactions within the DDN 1 are handled through an internal Extranet. The Extranet is a browser-based application that may manage the following exemplary tasks: (1) scheduling of content downloads for each theater 2, as well as live events over the satellite 30 or terrestrial network; (2) taking orders from theater representatives and scheduling for duplication of films; (3) command and control software that enables real-time monitoring and reporting on the satellite 30 network and/or on the terrestrial network; (4) command dial-up access for those theaters 2 with caching server 80 that are not connected to a network enabling them to report their status on a preferably schedule; (5) report software for marketing and businesses; (6) individually addressable  
25 screens that allow screen management software to place appropriate programming on each screen in theaters, as well as in the theater lobbies; and (7) screen management software that takes into account the available bandwidth with regard to all download requests and network requirements, including scheduled live events, to schedule available time to download programs.

Control and scheduling software that runs on the internal Extranet may perform the exemplary tasks and functions of providing (1) an ability to regulate and restrict the allowed viewing only to theater and times authorized by a global administrator; (2) an ability to rotate encryption keys based on the chosen encryption technology; (3) an ability to modify the transmission schedule; (4) an ability to monitor the operational status and health of the DDN 1; (5) an ability to log and confirm actions or group of actions by the theater equipment; and (6) an ability to allow each theater region to log ticket sales and attendance information.

The digital cinema equipment in theater 2 may support, inter alia, the exemplary functions of (1) the management of theater equipment, such as lighting and curtains; (2) the program status for each screen and any lobby monitors; (3) the assessment of ticket sales and actual attendance for each event; and (4) the scheduling and schedule reporting for film showings and other relevant events to Internet movie web sites comprising transport segment 65. Additionally, theater store/forward server 75 provides important operational control functions of the distribution network for each theater 2. Each store/forward server 75 preferably contains sufficient storage capacity and has sufficient bandwidth to support multiple (e.g., 4 digital projectors) digital projectors 105 and associated screens in each theater 2 (e.g., 45Mbps x 4 projectors = 180Mbps plus up to 10Mbps per (optional) preview screen in the theater lobby), as well as hot swappable RAID 0+1 disk arrays capable of holding four films (e.g., 40G per film x 4 films = 160G) plus any promotional material (e.g., video advertisements and trailers and (optional) lobby kiosk material). One device suitable for implementing store/forward server 75 is a QuBit™ server available from QuVIS, Inc. Additionally, there are suitable servers available from other manufacturers such as Grass Valley, Avica, EVS, and Technicolor Digital Cinema.

Projector system 105 preferably handled 24 hertz, as well as other possible frame rates. Examples of suitable projectors 105 that are currently available include, but are not limited to, Texas Instruments Digital Light Processing™ (DPL) projectors, and Hughes-JVC's Direct-Drive Image Light Amplifier™ (D-ILA) projectors.

In another aspect of the present teachings, a form generation capability is provided by DDN 1 as shown in FIG. 10. Forms, questionnaires, coupons, vouchers, or other information can be transmitted from a remote location form generator 150 to a data collection device 160 at theater 2 via transport mechanism 65 and data routing device 155. In another embodiment, the forms, questionnaires, coupons, vouchers, or other information can be locally transmitted from screen management system 102 to data collection device 160. Data collection device 160 can be a PDA, mobile telephone, portable computer, pager, or other device configured to receive the communication of the forms, etc. Data related to the transmitted the forms and provided in response thereto is transmitted back to form generator 150 via transport mechanism 65 utilizing the communication links employed therein.

Referring to FIG. 2, pre-recorded content is content that has been entirely gathered before an exhibition. To enable the broadcast of content at high speed (currently, approximately 40Mbps), DDN 1 is preferably configured to use windows of off-peak satellite time. Compressed files are sent from the central content server 10 to each theater server 75 at an off-peak time. Each theater 2 with satellite equipment preferably has a permanent connection to the Internet via a dedicated Public Owned Telephone System (POTS) dial-up line or other suitable connection such as DSL, Cable, or T1 connection. This enables DDN 1 to ensure that data packets are arriving at each theater 2. It also enables the reports on health and up-load status to occur on a periodic basis. Some theaters 2 may not be located in an area that is practical for satellite installation, such as in certain urban areas or where zoning laws prevent the use of satellite antennas. In these situations, a high speed land line connection such as, for example, a terrestrial DS3 connection can be employed. Content broadcasts are coordinated on both the terrestrial and satellite networks. In the event that a theater 2 has a DS3 connection, there is no need for the POTS line as the system health and status reports may be uploaded via the DS3 network.

Referring to FIG.3, if live content is not available via a satellite as part of transport segment 65, a commercial free, third party distribution feed 21 can be routed to the uplink center via a terrestrial network including terrestrial network router 120. Any necessary

conversion to a format native to projector system 105 can be performed by, for example, ATSC encoder 130. The feed is then routed over DDN 1 via satellite 30 and via the terrestrial network through terrestrial network router 125 for those theaters 2 that do not support satellite downlink capability.

5

Referring to FIG.4, live content may be made available via the satellite network forming part of transport segment 65 shown in FIG. 1. In this situation, the uplink provider receives a commercial-free distribution feed 21 at one of their dishes 140 from a broadcaster's satellite 135 or a terrestrial network, performs any necessary video conversion, and uplinks the live feed content to the DDN 1 using, for example, the ATSC encoder 130. This content data stream is also fed to those theaters 2 that are only accessible via the terrestrial network (e.g., the DS3 network) through the terrestrial network router 125.

10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65  
66  
67  
68  
69  
70  
71  
72  
73  
74  
75  
76  
77  
78  
79  
80  
81  
82  
83  
84  
85  
86  
87  
88  
89  
90  
91  
92  
93  
94  
95  
96  
97  
98  
99  
100  
101  
102  
103  
104  
105  
106  
107  
108  
109  
110  
111  
112  
113  
114  
115  
116  
117  
118  
119  
120  
121  
122  
123  
124  
125  
126  
127  
128  
129  
130  
131  
132  
133  
134  
135  
136  
137  
138  
139  
140  
141  
142  
143  
144  
145  
146  
147  
148  
149  
150  
151  
152  
153  
154  
155  
156  
157  
158  
159  
160  
161  
162  
163  
164  
165  
166  
167  
168  
169  
170  
171  
172  
173  
174  
175  
176  
177  
178  
179  
180  
181  
182  
183  
184  
185  
186  
187  
188  
189  
190  
191  
192  
193  
194  
195  
196  
197  
198  
199  
200  
201  
202  
203  
204  
205  
206  
207  
208  
209  
210  
211  
212  
213  
214  
215  
216  
217  
218  
219  
220  
221  
222  
223  
224  
225  
226  
227  
228  
229  
230  
231  
232  
233  
234  
235  
236  
237  
238  
239  
240  
241  
242  
243  
244  
245  
246  
247  
248  
249  
250  
251  
252  
253  
254  
255  
256  
257  
258  
259  
260  
261  
262  
263  
264  
265  
266  
267  
268  
269  
270  
271  
272  
273  
274  
275  
276  
277  
278  
279  
280  
281  
282  
283  
284  
285  
286  
287  
288  
289  
290  
291  
292  
293  
294  
295  
296  
297  
298  
299  
300  
301  
302  
303  
304  
305  
306  
307  
308  
309  
310  
311  
312  
313  
314  
315  
316  
317  
318  
319  
320  
321  
322  
323  
324  
325  
326  
327  
328  
329  
330  
331  
332  
333  
334  
335  
336  
337  
338  
339  
340  
341  
342  
343  
344  
345  
346  
347  
348  
349  
350  
351  
352  
353  
354  
355  
356  
357  
358  
359  
360  
361  
362  
363  
364  
365  
366  
367  
368  
369  
370  
371  
372  
373  
374  
375  
376  
377  
378  
379  
380  
381  
382  
383  
384  
385  
386  
387  
388  
389  
390  
391  
392  
393  
394  
395  
396  
397  
398  
399  
400  
401  
402  
403  
404  
405  
406  
407  
408  
409  
410  
411  
412  
413  
414  
415  
416  
417  
418  
419  
420  
421  
422  
423  
424  
425  
426  
427  
428  
429  
430  
431  
432  
433  
434  
435  
436  
437  
438  
439  
440  
441  
442  
443  
444  
445  
446  
447  
448  
449  
450  
451  
452  
453  
454  
455  
456  
457  
458  
459  
460  
461  
462  
463  
464  
465  
466  
467  
468  
469  
470  
471  
472  
473  
474  
475  
476  
477  
478  
479  
480  
481  
482  
483  
484  
485  
486  
487  
488  
489  
490  
491  
492  
493  
494  
495  
496  
497  
498  
499  
500  
501  
502  
503  
504  
505  
506  
507  
508  
509  
510  
511  
512  
513  
514  
515  
516  
517  
518  
519  
520  
521  
522  
523  
524  
525  
526  
527  
528  
529  
530  
531  
532  
533  
534  
535  
536  
537  
538  
539  
540  
541  
542  
543  
544  
545  
546  
547  
548  
549  
550  
551  
552  
553  
554  
555  
556  
557  
558  
559  
560  
561  
562  
563  
564  
565  
566  
567  
568  
569  
570  
571  
572  
573  
574  
575  
576  
577  
578  
579  
580  
581  
582  
583  
584  
585  
586  
587  
588  
589  
590  
591  
592  
593  
594  
595  
596  
597  
598  
599  
600  
601  
602  
603  
604  
605  
606  
607  
608  
609  
610  
611  
612  
613  
614  
615  
616  
617  
618  
619  
620  
621  
622  
623  
624  
625  
626  
627  
628  
629  
630  
631  
632  
633  
634  
635  
636  
637  
638  
639  
640  
641  
642  
643  
644  
645  
646  
647  
648  
649  
650  
651  
652  
653  
654  
655  
656  
657  
658  
659  
660  
661  
662  
663  
664  
665  
666  
667  
668  
669  
670  
671  
672  
673  
674  
675  
676  
677  
678  
679  
680  
681  
682  
683  
684  
685  
686  
687  
688  
689  
690  
691  
692  
693  
694  
695  
696  
697  
698  
699  
700  
701  
702  
703  
704  
705  
706  
707  
708  
709  
710  
711  
712  
713  
714  
715  
716  
717  
718  
719  
720  
721  
722  
723  
724  
725  
726  
727  
728  
729  
730  
731  
732  
733  
734  
735  
736  
737  
738  
739  
740  
741  
742  
743  
744  
745  
746  
747  
748  
749  
750  
751  
752  
753  
754  
755  
756  
757  
758  
759  
760  
761  
762  
763  
764  
765  
766  
767  
768  
769  
770  
771  
772  
773  
774  
775  
776  
777  
778  
779  
780  
781  
782  
783  
784  
785  
786  
787  
788  
789  
790  
791  
792  
793  
794  
795  
796  
797  
798  
799  
800  
801  
802  
803  
804  
805  
806  
807  
808  
809  
810  
811  
812  
813  
814  
815  
816  
817  
818  
819  
820  
821  
822  
823  
824  
825  
826  
827  
828  
829  
830  
831  
832  
833  
834  
835  
836  
837  
838  
839  
840  
841  
842  
843  
844  
845  
846  
847  
848  
849  
850  
851  
852  
853  
854  
855  
856  
857  
858  
859  
860  
861  
862  
863  
864  
865  
866  
867  
868  
869  
870  
871  
872  
873  
874  
875  
876  
877  
878  
879  
880  
881  
882  
883  
884  
885  
886  
887  
888  
889  
890  
891  
892  
893  
894  
895  
896  
897  
898  
899  
900  
901  
902  
903  
904  
905  
906  
907  
908  
909  
910  
911  
912  
913  
914  
915  
916  
917  
918  
919  
920  
921  
922  
923  
924  
925  
926  
927  
928  
929  
930  
931  
932  
933  
934  
935  
936  
937  
938  
939  
940  
941  
942  
943  
944  
945  
946  
947  
948  
949  
950  
951  
952  
953  
954  
955  
956  
957  
958  
959  
960  
961  
962  
963  
964  
965  
966  
967  
968  
969  
970  
971  
972  
973  
974  
975  
976  
977  
978  
979  
980  
981  
982  
983  
984  
985  
986  
987  
988  
989  
990  
991  
992  
993  
994  
995  
996  
997  
998  
999  
1000  
1001  
1002  
1003  
1004  
1005  
1006  
1007  
1008  
1009  
1010  
1011  
1012  
1013  
1014  
1015  
1016  
1017  
1018  
1019  
1020  
1021  
1022  
1023  
1024  
1025  
1026  
1027  
1028  
1029  
1030  
1031  
1032  
1033  
1034  
1035  
1036  
1037  
1038  
1039  
1040  
1041  
1042  
1043  
1044  
1045  
1046  
1047  
1048  
1049  
1050  
1051  
1052  
1053  
1054  
1055  
1056  
1057  
1058  
1059  
1060  
1061  
1062  
1063  
1064  
1065  
1066  
1067  
1068  
1069  
1070  
1071  
1072  
1073  
1074  
1075  
1076  
1077  
1078  
1079  
1080  
1081  
1082  
1083  
1084  
1085  
1086  
1087  
1088  
1089  
1090  
1091  
1092  
1093  
1094  
1095  
1096  
1097  
1098  
1099  
1100  
1101  
1102  
1103  
1104  
1105  
1106  
1107  
1108  
1109  
1110  
1111  
1112  
1113  
1114  
1115  
1116  
1117  
1118  
1119  
1120  
1121  
1122  
1123  
1124  
1125  
1126  
1127  
1128  
1129  
1130  
1131  
1132  
1133  
1134  
1135  
1136  
1137  
1138  
1139  
1140  
1141  
1142  
1143  
1144  
1145  
1146  
1147  
1148  
1149  
1150  
1151  
1152  
1153  
1154  
1155  
1156  
1157  
1158  
1159  
1160  
1161  
1162  
1163  
1164  
1165  
1166  
1167  
1168  
1169  
1170  
1171  
1172  
1173  
1174  
1175  
1176  
1177  
1178  
1179  
1180  
1181  
1182  
1183  
1184  
1185  
1186  
1187  
1188  
1189  
1190  
1191  
1192  
1193  
1194  
1195  
1196  
1197  
1198  
1199  
1200  
1201  
1202  
1203  
1204  
1205  
1206  
1207  
1208  
1209  
1210  
1211  
1212  
1213  
1214  
1215  
1216  
1217  
1218  
1219  
1220  
1221  
1222  
1223  
1224  
1225  
1226  
1227  
1228  
1229  
1230  
1231  
1232  
1233  
1234  
1235  
1236  
1237  
1238  
1239  
1240  
1241  
1242  
1243  
1244  
1245  
1246  
1247  
1248  
1249  
1250  
1251  
1252  
1253  
1254  
1255  
1256  
1257  
1258  
1259  
1260  
1261  
1262  
1263  
1264  
1265  
1266  
1267  
1268  
1269  
1270  
1271  
1272  
1273  
1274  
1275  
1276  
1277  
1278  
1279  
1280  
1281  
1282  
1283  
1284  
1285  
1286  
1287  
1288  
1289  
1290  
1291  
1292  
1293  
1294  
1295  
1296  
1297  
1298  
1299  
1300  
1301  
1302  
1303  
1304  
1305  
1306  
1307  
1308  
1309  
1310  
1311  
1312  
1313  
1314  
1315  
1316  
1317  
1318  
1319  
1320  
1321  
1322  
1323  
1324  
1325  
1326  
1327  
1328  
1329  
1330  
1331  
1332  
1333  
1334  
1335  
1336  
1337  
1338  
1339  
1340  
1341  
1342  
1343  
1344  
1345  
1346  
1347  
1348  
1349  
1350  
1351  
1352  
1353  
1354  
1355  
1356  
1357  
1358  
1359  
1360  
1361  
1362  
1363  
1364  
1365  
1366  
1367  
1368  
1369  
1370  
1371  
1372  
1373  
1374  
1375  
1376  
1377  
1378  
1379  
1380  
1381  
1382  
1383  
1384  
1385  
1386  
1387  
1388  
1389  
1390  
1391  
1392  
1393  
1394  
1395  
1396  
1397  
1398  
1399  
1400  
1401  
1402  
1403  
1404  
1405  
1406  
1407  
1408  
1409  
1410  
1411  
1412  
1413  
1414  
1415  
1416  
1417  
1418  
1419  
1420  
1421  
1422  
1423  
1424  
1425  
1426  
1427  
1428  
1429  
1430  
1431  
1432  
1433  
1434  
1435  
1436  
1437  
1438  
1439  
1440  
1441  
1442  
1443  
1444  
1445  
1446  
1447  
1448  
1449  
1450  
1451  
1452  
1453  
1454  
1455  
1456  
1457  
1458  
1459  
1460  
1461  
1462  
1463  
1464  
1465  
1466  
1467  
1468  
1469  
1470  
1471  
1472  
1473  
1474  
1475  
1476  
1477  
1478  
1479  
1480  
1481  
1482  
1483  
1484  
1485  
1486  
1487  
1488  
1489  
1490  
1491  
1492  
1493  
1494  
1495  
1496  
1497  
1498  
1499  
1500  
1501  
1502  
1503  
1504  
1505  
1506  
1507  
1508  
1509  
1510  
1511  
1512  
1513  
1514  
1515  
1516  
1517  
1518  
1519  
1520  
1521  
1522  
1523  
1524  
1525  
1526  
1527  
1528  
1529  
1530  
1531  
1532  
1533  
1534  
1535  
1536  
1537  
1538  
1539  
1540  
1541  
1542  
1543  
1544  
1545  
1546  
1547  
1548  
1549  
1550  
1551  
1552  
1553  
1554  
1555  
1556  
1557  
1558  
1559  
1560  
1561  
1562  
1563  
1564  
1565  
1566  
1567  
1568  
1569  
1570  
1571  
1572  
1573  
1574  
1575  
1576  
1577  
1578  
1579  
1580  
1581  
1582  
1583  
1584  
1585  
1586  
1587  
1588  
1589  
1590  
1591  
1592  
1593  
1594  
1595  
1596  
1597  
1598  
1599  
1600  
1601  
1602  
1603  
1604  
1605  
1606  
1607  
1608  
1609  
1610  
1611  
1612  
1613  
1614  
1615  
1616  
1617  
1618  
1619  
1620  
1621  
1622  
1623  
1624  
1625  
1626  
1627  
1628  
1629  
1630  
1631  
1632  
1633  
1634  
1635  
1636  
1637  
1638  
1639  
1640  
1641  
1642  
1643  
1644  
1645  
1646  
1647  
1648  
1649  
1650  
1651  
1652  
1653  
1654  
1655  
1656  
1657  
1658  
1659  
1660  
1661  
1662  
1663  
1664  
1665  
1666  
1667  
1668  
1669  
1670  
1671  
1672  
1673  
1674  
1675  
1676  
1677  
1678  
1679  
1680  
1681  
1682  
1683  
1684  
1685  
1686  
1687  
1688  
1689  
1690  
1691  
1692  
1693  
1694  
1695  
1696  
1697  
1698  
1699  
1700  
1701  
1702  
1703  
1704  
1705  
1706  
1707  
1708  
1709  
1710  
1711  
1712  
1713  
1714  
1715  
1716  
1717  
1718  
1719  
1720  
1721  
1722  
1723  
1724  
1725  
1726  
1727  
1728  
1729  
1730  
1731  
1732  
1733  
1734  
1735  
1736  
1737  
1738  
1739  
1740  
1741  
1742  
1743  
1744  
1745  
1746  
1747  
1748  
1749  
1750  
1751  
1752  
1753  
1754  
1755  
1756  
1757  
1758  
1759  
1760  
1761  
1762  
1763  
1764  
1765  
1766  
1767  
1768  
1769  
1770  
1771  
1772  
1773  
1774  
1775  
1776  
1777  
1778  
1779  
1780  
1781  
1782  
1783  
1784  
1785  
1786  
1787  
1788  
1789  
1790  
1791  
1792  
1793  
1794  
1795  
1796  
1797  
1798  
1799  
1800  
1801  
1802  
1803  
1804  
1805  
1806  
1807  
1808  
1809  
1810  
1811  
1812  
1813  
1814  
1815  
1816  
1817  
1818  
1819  
1820  
1821  
1822  
1823  
1824  
1825  
1826  
1827  
1828  
1829  
1830  
1831  
1832  
1833  
1834  
1835  
1836  
1837  
1838  
1839  
1840  
1841  
1842  
1843  
1844  
1845  
1846  
1847  
1848  
1849  
1850  
1851  
1852  
1853  
1854  
1855  
1856  
1857  
1858  
1859  
1860  
1861  
1862  
1863  
1864  
1865  
1866  
1867  
1868  
1869  
1870  
1871  
1872  
1873  
1874  
1875  
1876  
1877  
1878  
1879  
1880  
1881  
1882  
1883  
1884  
1885  
1886  
1887  
1888  
1889  
1890  
1891  
1892  
1893  
1894  
1895  
1896  
1897  
1898  
1899  
1900  
1901  
1902  
1903  
1904  
1905  
1906  
1907  
1908  
1909  
1910  
1911  
1912  
1913  
1914  
1915  
1916  
1917  
1918  
1919  
1920  
1921  
1922  
1923  
1924  
1925  
1926  
1927  
1928  
1929  
1930  
1931  
1932  
1933  
1934  
1935  
1936  
1937  
1938  
1939  
1940  
1941  
1942  
1943  
1944  
1945  
1946  
1947  
1948  
1949  
1950  
1951  
1952  
1953  
1954  
1955  
1956  
1957  
1958  
1959  
1960  
1961  
1962  
1963  
1964  
1965  
1966  
1967  
1968  
1969  
1970  
1971  
1972  
1973  
1974  
1975  
1976  
1977  
1978  
1979  
1980  
1981  
1982  
1983  
1984  
1985  
1986  
1987  
1988  
1989  
1990  
1991  
1992  
1993  
1994  
1995  
1996  
1997  
1998  
1999  
2000  
2001  
2002  
2003  
2004  
2005  
2006  
2007  
2008  
2009  
2010  
2011  
2012  
2013  
2014  
2015  
2016  
2017  
2018  
2019  
2020  
2021  
2022  
2023  
2024  
2025  
2026  
2027  
2028  
2029  
2030  
2031  
2032  
2033  
2034  
2035  
2036  
2037  
2038  
2039  
2040  
2041  
2042  
2043  
2044  
2045  
2046  
2047  
2048  
2049  
2050  
2051  
2052  
2053  
2054  
2055  
2056  
2057  
2058  
2059  
2060  
2061  
2062  
2063  
2064  
2065  
2066  
2067  
2068  
2069  
2070  
2071  
2072  
2073  
2074  
2075  
2076  
2077  
2078  
2079  
2080  
2081  
2082  
2083  
2084  
2085  
2086  
2087  
2088  
2089  
2090  
2091  
2092  
2093  
2094  
2095  
2096  
2097  
2098  
2099  
2100  
2101  
2102  
2103  
2104  
2105  
2106  
2107  
2108  
2109  
2110  
2111  
2112  
2113  
2114  
2115  
2116  
2117  
2118  
2119  
2120  
2121  
2122  
2123  
2124  
2125  
2126  
2127  
2128  
2129  
2130  
2131  
2132  
2133  
2134  
2135  
2136  
2137  
2138  
2139  
2140  
2141  
2142  
2143  
2144  
2145  
2146  
2147  
2148  
2149  
2150  
2151  
2152  
2153  
2154  
2155  
2156  
2157  
2158  
2159  
2160  
2161  
2162  
2163  
2164  
2165  
2166  
2167  
2168  
2169  
2170  
2171  
2172  
2173  
2174  
2175  
2176  
2177  
2178  
2179  
2180  
2181  
2182  
2183  
2184  
2185  
2186  
2187  
2188  
2189  
2190  
2191  
2192

delivery of content to theatres not equipped to receive satellite transmissions using terrestrial router 125.

As previously stated the content leaving content server 5 is strongly encrypted to discourage unauthorized interception and viewing or recording of the transmitted signal, and the store/forward server 75 decrypts the content prior to the display thereof. It was also stated that the store/forward server 75 may provide a lighter encryption (e.g., data scrambling). It should be appreciated that other types of encryption can be used on the link between store/forward server 75 and projection system 105 without departing from the scope of the present invention.

As such, FIG. 13 is a block diagram of a further embodiment of this invention, wherein an interface unit 76 is disposed between store/forward server 75 and digital projection system 105. In this embodiment the distributed content is stored in the received encrypted form in store/forward server 75 and subsequently transmitted, still encrypted (and compressed) to interface unit 76. The data may be in MPEG2 format, and can be transmitted over a SCSI or a fiber channel.

Referring also to FIG. 14, which shows a high level block diagram that includes the digital content data stream output from store/forward server 75 to interface unit 76, it can be seen that the digital content stream includes embedded metadata for configuring the interface unit 76.

In the embodiment depicted in FIGS. 13 and 14 interface unit 76 operates to decompress and decrypt the received data stream, and to provide the decompressed and lightly encrypted or scrambled data stream to the projector 105. In this case, an interface module 106 is installed in digital projector system 105 for decrypting or descrambling the content data stream before projecting same on the screen for the viewers.

Interface module 76 may include a 14-bit video codec to implement video decompression and processing. The use of the 14-bit or greater codec is preferred over a conventional 8-bit MPEG or similar codec in order to reduce the amount of color error over that experienced with the conventional 8-bit MPEG codec (typically about 2% color error when compared with uncompressed NTSC or PAL color coding, error is greater when compared to film). In a presently preferred embodiment, the content is not compressed, and instead is transmitted from content server 10 to theater 2 and digital projector system 105 in an uncompressed format.

It should be appreciated that it is desirable, but not necessary, to integrate the functionality of store/forward server 75 and interface unit 76 so as to arrive at the configuration depicted in FIG. 1. It is also desirable, but not necessary, to integrate the functionality of caching server 80 with store/forward server 75; and high definition or alternate video decoder 82, AV matrix 84 and store/forward server 75.

While described above in the context of presently preferred embodiments, those skilled in the art should realize that various modifications to these teachings can be made, and that the modified system will still fall within the scope of these teachings. As an example, the backchannel 4 can be used to support interactive gaming by audience members at the plurality of theaters 2. Further by example, these teachings are not intended to be limited to any of the various data formats, data rates, specific numbers of components, or to any of the specific examples of suitable system components that were disclosed above.